



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/511,986
Filing Date: February 24, 2000
Appellant(s): WILLIAMS, VERNON M.

Brick G. Power
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed February 9, 2005 appealing from the Office action mailed April 7, 2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,969,424	Matsuki et al.	10-1999
4,610,941	Sullivan	9-1986
4,752,498	Fudim	6-1988
4,954,873	Lee et al.	9-1990
5,007,576	Congleton et al.	4-1991

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 64-66, 68, 75, 77-79 and 81-83 are rejected under 35 U.S.C. 102(e) as being anticipated by Matsuki et al.

Regarding claim 64, Matsuki et al. teach in figure 2 and related text (column 6, line 51 to column 7, line 37) a semiconductor device assembly, comprising: a carrier 11, 12 (column 7, lines 28-30) including contacts and carrying circuitry in communication with the contacts; and at least one semiconductor die 1, 2 adjacent the carrier, the semiconductor die including bond pads 4 (see plurality of bond pads in figure 1); and conductive elements 7 (see plurality of conductive elements 7 in figure 1) extending

between and electrically contacting contacts (or wires) 11 (column 7, line 30) of the carrier and corresponding bond pads 4 to electrically connect circuitry of the at least one semiconductor die with the circuitry of the carrier, each of the conductive elements 7 including a plurality of superimposed, contiguous, mutually adhered layers 13, 15, each of the layers comprising copper a conductive material (column 8, lines 31-34).

Although Matsuki et al. do not state that all electronic circuit element 2 is a semiconductor die, electronic circuit element 2 is a semiconductor device, and thus rendering it a semiconductor chip.

Note that conductive elements 7 electrically contact contacts 11 of the carrier to corresponding bond pads 4, because during bonding contacts 11 are connected to bumps 10 (column 9, lines 11-15).

Regarding claim 75, Matsuki et al. teach in figure 2 substantially the entire claimed structure, as applied to claim 64 above, wherein the part of layer 11 contacting bump 10 during bonding is the at least one contact pad 11, and thus the at least one conductive element is in contact with both first and second contact pads.

Regarding claim 65, although Matsuki et al. do not categorize film carrier as a carrier substrate, a film carrier is synonymous to a carrier substrate.

Regarding claim 66, Matsuki et al. teach in figure 2 a carrier comprises leads 11 (column 7, line 30).

Regarding claims 68 and 77, Matsuki et al. teach in figure 2 conductive material comprises a metal (column 8, lines 58-61).

Regarding claims 78-79, Matsuki et al. teach in figure 2 at least one of the first and second semiconductor device components comprises a packaged semiconductor die 2.

Regarding claim 81, Matsuki et al. teach in figure 2 at least one of the first and second semiconductor device components comprises a carrier substrate 11, 12.

Regarding claim 82, Matsuki et al. teach in figure 2 a carrier substrate includes a support structure 12 and at least one conductive element 7 in communication with the at least one contact pad 11 thereof. Layer 12 is a support structure, because during bonding contacts 11 are connected to bumps 10, and the substrate supports chip 2.

Regarding claim 83, Matsuki et al. teach in figure 2 at least one of the at least one conductive element 7 and the support structure 12 comprises a plurality of superimposed, contiguous, mutually adhered layers 13, 15, 16 of material.

2. Claims 47, 50-54, 58-59, 62-63, 110, 112-116, 119-120 and 123-124 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sullivan in view of Fudim.

Regarding claims 47, 52, 110, 114 and 115, Sullivan teaches in figures 1 and 2 and related text a conductive trace 15, 11 (on a printed wiring board) at least partially formed on at least one semiconductor device component 10, comprising a plurality of identical superimposed, contiguous, mutually adhered layers 11, each of the layers comprising conductive polymer, at least a portion of the conductive trace being configured to extend and conduct electrical signals along a plane which is parallel to a plane in which at least one semiconductor device component is located (column 5, lines 19-35 and column 6, lines 57-68).

Sullivan does not explicitly state that conductive polymer 11 comprises a plurality of superimposed, contiguous, mutually adhered layers.

A plurality of superimposed, contiguous, mutually adhered conductive polymer layers are indistinguishable from one another, and thus can be considered as one layer.

Fudim teaches in figures 3A and 4B forming conductive polymer by solidifying liquid conductive polymer 11 (the thick lines in figure 4B) to form conductive polymer 25b.

Fudim further teaches that this process can be repeated many times (column 4, lines 5-6). Solidifying liquid polymer material multiple times would result in one indistinguishable conductive polymer layer. Therefore, there is no structural difference between a conductive polymer that is formed by solidifying the liquid polymer one time and a conductive polymer that is formed by solidifying the liquid polymer plurality of times.

Sullivan also teaches forming conductive polymer 11 by solidifying liquid conductive polymer. Therefore, the claimed limitations of a plurality of superimposed, contiguous,

mutually adhered conductive polymer layers are either inherent in Sullivan's device that constitute a conductive polymer, or it would have been obvious, in view of Fudim, that the multiple steps of forming the conductive polymer results in a conductive polymer which is composed of plurality of superimposed, contiguous, mutually adhered indistinguishable conductive polymer layers.

Furthermore, the formation of a plurality of superimposed, contiguous, mutually adhered conductive polymer layers is a process limitation which would not carry patentable weight in this claim drawn to a structure, because distinct structure is not necessarily produced.

Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and *In re Marosi et al.*, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that the applicant has the burden of proof in such cases, as the above case law makes clear.

Regarding claims 50, 51, 53, 112 and 113 prior art teaches a conductive trace of a printed wiring board configured to be carried by a single semiconductor device

component and configured to at least partially electrically connect two semiconductor device components and substantially entirely carried by a semiconductor device component.

Regarding claims 54, 59, 116 and 120, Sullivan teaches in figure 2 a semiconductor device component comprises a layer of a carrier substrate 10.

Regarding claims 58 and 119, Sullivan teaches in figure 2 at least one conductive trace communicates with a contact of the semiconductor device component.

Regarding claims 62, 63, 123 and 124, Sullivan teaches in figure 2 semiconductor device component comprises leads 15 wherein the at least one conductive element contacts one of the leads.

3. Claims 48, 55, 56, 60, 61, 111, 117, 118, 121 and 122 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sullivan and Fudim, as applied to claims 47, 52, 110 and 114 above, and further in view of Lee.

Regarding claims 48, 56, 111 and 118, Sullivan and Fudim teach substantially the entire claimed structure, as applied to claims 47, 52, 110 and 114 above, except a polymer being a thermoplastic conductive elastomer.

Lee teaches using a thermoplastic conductive elastomer as a conductive polymer to interface between electronic devices and contact pads. It would have been obvious to a

person of ordinary skill in the art at the time the invention was made to use a polymer being a thermoplastic conductive elastomer in Sullivan and Fudim's device in order to provide more flexibility to the wirings of the device.

Regarding claims 55, 60, 61, 117, 121 and 122, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a dielectric layer disposed on an active surface of a semiconductor die in a packaged semiconductor device in prior art's device in order to operate the device in its intended use (by using a semiconductor die which must include an active surface) and in order to protect the device (by using a dielectric layer on the active surface and by packaging the device) by conventional means, of which official notice is taken.

4. Claims 67 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuki et al. in view of Lee.

Matsuki et al teach substantially the entire claimed structure, as applied to claims 64 and 75, except a polymer being a thermoplastic conductive elastomer.

Lee teaches using a thermoplastic conductive elastomer as a conductive polymer to interface between electronic devices and contact pads. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a polymer being a thermoplastic conductive elastomer in Matsuki et al.'s device in order to provide more flexibility to the wirings of the device.

5. Claims 75 and 84-85 are rejected under 35 U.S.C. 103(a) as being unpatentable over Congleton et al. in view of Matsuki et al.

Regarding claims 75 and 84-85, Congleton et al. teach in figure 1e and related text a semiconductor device assembly comprising a first semiconductor device component 10 including at least one contact pad 10a (see figure 1c); a second semiconductor device component 30 including at least one contact pad 30a; and at least one conductive element 16 (see figure 1c) connecting the at least one contact pad of the first semiconductor device component to the at least one contact pad of the second semiconductor device component, wherein at least one conductive element 16 is located on a surface of each of the first 10 and second 30 semiconductor device components, and wherein the at least one conductive element 16 extends across a peripheral edge of at least one of the first and second semiconductor device components (column 4, lines 5-9 and column 5, lines 7-27).

Congleton et al. do not teach at least one conductive element comprising a plurality of superimposed, contiguous, mutually adhered layers comprising conductive material.

Matsuki et al. teach in figure 2 and related text at least one conductive element 7 comprising a plurality of superimposed, contiguous, mutually adhered layers 13, 15, each of the layers comprising copper, a conductive material (column 8, lines 31-34).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use at least one conductive element comprising a plurality of superimposed, contiguous, mutually adhered layers comprising conductive material, as taught by Matsuki et al., in Congleton et al.'s device in order to improve the adhesion

between the conductive element and the surfaces there under, while providing good conductor conductivity. The combination is motivated by the teachings of Matsuki et al. who point out the advantages of using a conductive element comprising a plurality of superimposed, contiguous, mutually adhered layers comprising conductive material (column 7, line 65 to column 8, line 44).

(10) Response to Argument

1. Appellant argues on page 10 that Matsuki et al. do not teach conductive elements 7 contacting contact (or wire) 11 of the carrier 12, because solder ball 10 or a bond wire is required to establish communication between conductive elements 7 and its corresponding contact 11.

Claim 64 recites “conductive elements extending between and contacting contacts of the carrier and corresponding bond pads to electrically connect circuitry of the at least one semiconductor die with the circuitry of the carrier”. The broad recitation of claim 64 does not require the conductive elements to make direct physical contact with the contacts. The conductive elements are only required to contact the contacts in order to electrically connect circuitry of the at least one semiconductor die with the circuitry of the carrier. An electrical contact between the conductive elements and the contacts is sufficient to electrically connect circuitry of the at least one semiconductor die with the circuitry of the carrier.

Matsuki et al. (column 9, lines 14-16) and appellant (appeal brief, page 9, last two lines) both state that conductive elements 7 extending between and electrically contacting contacts of the carrier and corresponding bond pads to electrically connect circuitry of the at least one semiconductor die with the circuitry of the carrier. Therefore, Matsuki et al. teach conductive elements extending between and contacting contacts of the carrier and corresponding bond pads to electrically connect circuitry of the at least one semiconductor die with the circuitry of the carrier, as claimed.

2. Appellant argues on page 12 that Matsuki et al. do not teach a carrier substrate 12 includes a conductive trace that is carried by a support structure thereof and a support structure includes a plurality of superimposed, contiguous, mutually adhered layers, as recited in claims 82 and 83.

Regarding claims 82 and 83, Matsuki et al. teach in figure 2 a carrier substrate (taken as layers 1, 3, 5 and 12) includes a support structure 12 and at least one conductive element 7 in communication with the at least one contact pad 11 thereof. Layer 12 is a support structure, because after bonding contacts 11 are connected to bumps 10, and the substrate supports chip 2. At least one of the at least one conductive element 7 and the support structure 12 comprises a plurality of superimposed, contiguous, mutually adhered layers 13, 15, 16 of material.

The carrier substrate recited in claims 82 and 83 includes the entire block of structure depicted in figure 2 (that is, layers 1, 3, 5 and 12), because Matsuki et al. state

that layer 1 is a substrate (column 6, line 56), layer 5 is a substrate (column 6, line 63) and layer 12 is a substrate (carrier, column 7, line 28).

3. Appellant argues on pages 15 and 16 that Sullivan and Fudim do not teach a conductive polymer comprises a plurality of superimposed, contiguous, mutually adhered layers. Appellant further argues that the examiner ignored the law and disregarded the claimed limitations of “plurality of....layers”, by stating that “a plurality of superimposed, contiguous, mutually adhered conductive polymer layers are indistinguishable from one another, and thus can be considered as one layer”.

Appellant claims a plurality of identical superimposed, contiguous, mutually adhered conductive polymer layers. Appellant states that in at least claims 47 and 114, each of the layers comprises the same conductive polymer (see brief, page 15, second and fifth paragraphs). The rest of the claims do not require the conductive polymer layers to comprise different conductive layers. Therefore, the claimed limitation of “the same conductive polymer” or “a plurality of identical superimposed, contiguous, mutually adhered conductive polymer layers” can apply to all the claims.

A plurality of identical superimposed, contiguous, mutually adhered conductive polymer layers that are indistinguishable from one another, are not structurally different from one conductive polymer layer being arbitrarily divided into different sections/layers. Therefore, a plurality of identical superimposed, contiguous, mutually adhered conductive polymer layers can be considered as one conductive polymer layer being arbitrarily divided into different sections/layers. Thus, a limitation of a plurality of

identical superimposed, contiguous, mutually adhered conductive polymer layers is a process limitation, which should carry patentable weight in claims drawn to a structure, because distinct structure is not necessarily produced.

Furthermore, the process of forming conductive polymer supports the position that the limitation of “a plurality of identical superimposed, contiguous, mutually adhered conductive polymer layers” is a process limitation. Fudim teaches in figures 3A and 4B solidifying liquid conductive polymer 11 (the thick lines in figure 4B) in order to obtain conductive polymer 25b. Fudim further teaches that this process can be repeated many times (column 4, lines 5-6). This means, a plurality of layers are formed on top of each other. Although Fudim teaches forming plurality of layers, solidifying liquid polymer material multiple times can result in one indistinguishable conductive polymer layer. There is no structural difference between a conductive polymer that is formed by solidifying the liquid polymer one time (that is, one layer is formed) and a conductive polymer that is formed by solidifying the liquid polymer plurality of times (that is, plurality of layers are formed). Note that Sullivan also teaches forming conductive polymer 11 by solidifying liquid conductive polymer.

Therefore, the claimed limitations of a plurality of superimposed, contiguous, mutually adhered conductive polymer layers are inherent in Sullivan’s device.

Moreover, claims 47, 50-54, 58-59, 62-63, 110, 112-116, 119-120 and 123-124 are rejected, in the alternative, as being obvious over Sullivan in view of Fudim. That is, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to form Sullivan’s conductive polymer in multiple steps, as taught

by Fudim, resulting in a conductive polymer which is composed of plurality of superimposed, contiguous, mutually adhered indistinguishable conductive polymer layers. The combination is motivated by the teachings of Fudim who points out the advantages of his method (see abstract).

4. Appellant argues on page 16 that prior art does not teach a conductive trace that comprises conductive polymer.

Sullivan teaches in figures 1 and 2 and related text a conductive trace 15, 11 (column 4, line 37) formed on a printed wiring board. Sullivan further teaches that it is conventional to form conductive polymer (column 5, lines 19-35 and column 6, lines 57-68) on a substrate (e.g. a printed circuit board). Therefore, Sullivan teaches a conductive trace that comprises conductive polymer.

5. Appellant argues on pages 18 and 19 that the anisotropic elastomeric conductors of Lee could not be used to form the lead wires 7 of Matsuki et al., because the anisotropic elastomeric conductors of Lee extend transversely and not laterally along the planes, and thus the lead wires 7 of Matsuki et al. (which comprise the anisotropic elastomeric conductors) would not be able to conduct electricity along the lengths thereof. Appellant further argues that an artisan would not be motivated to combine Lee with Matsuki et al.

Elastomeric conductors are materials known to conduct current in the z direction, and insulate in the x direction (see also Lee et al., columns 1 and 2). Positioning the

conductor transversely or laterally would not prevent the conductor from conducting current in the z direction. Lee supports this position by teaching that an elastomer can advantageously "conform closely to the contours of both surfaces of the devices which are being coupled" (column 3, lines 2-5). Therefore, the anisotropic elastomeric conductors of Lee would conduct current in Matsuki et al.'s device, when they are placed in both the traverse and lateral directions.

Furthermore, appellant teaches in paragraph [102] that conductive elements 20 can be a conductive elastomer or a metal. Figure 2 depicts conductive element 20 having transverse and lateral directions. Therefore, elastomer 20 in appellant's structure conduct electricity when the elastomer is positioned in the transverse and lateral directions. Lee's elastomer used in Matsuki et al.'s device would also conduct electricity when it is positioned in the transverse and lateral directions.

Moreover, Lee teaches using a thermoplastic conductive elastomer as a conductive polymer to interface between electronic devices and contact pads (abstract). Lee also teaches the advantages of using a thermoplastic conductive elastomer (column 3, lines 2-5). Therefore, an artisan would be motivated to use Lee's elastomer in Matsuki et al.'s device.

6. Appellant argues on pages 20 and 21 that an artisan would not be motivated to combine Congleton with Matsuki et al., because the contacts of both the semiconductor die and the carrier of Congleton are exposed, whereas the contacts 11 of carrier 12 of Matsuki et al. are not exposed, and thus it will be impossible "to directly connect leads

such as those described in Congleton to both the bond pads 4 and the contacts 11".

Appellant further argues that lead wires of Matsuki et al. are used within a redistribution layer and do not extend beyond the outer periphery of the package.

Congleton teaches copper "wire leads" 16 (column 4, lines 7-8) connecting the semiconductor die to the carrier. Matsuki et al. also teach copper "lead wires" 7 (column 4, lines 20-21) connecting a semiconductor die to the carrier. Therefore, it would be obvious for an artisan to use the copper lead wires of Matsuki et al. in Congleton's device. The fact that Matsuki et al. provide better protection to his copper lead wires (i.e. the wires are not exposed) than Congleton (wherein the wires are exposed) would not prevent an artisan from using the copper lead wires of Matsuki et al. in Congleton's device. In fact, an artisan would be motivated to use the multi-layered lead wires of Matsuki et al.'s device in Congleton's device, because one exposed wire of Congleton is more susceptible to damage than a multi-layered lead wires.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

Respectfully submitted,

Ori Nadav

Conferees:

Drew Dunn
/D. A. D./
TQAS, TC 2800

Lynne Gurley/L. A. G./

Supervisory Patent Examiner, Art Unit 2811

/Ori Nadav/

Primary Examiner, Art Unit 2811